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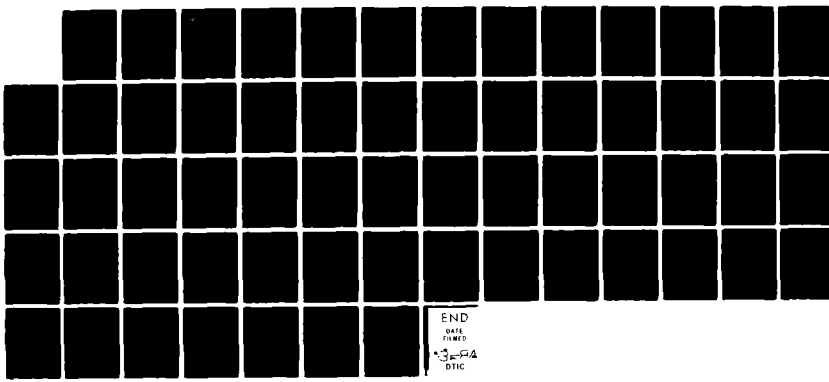

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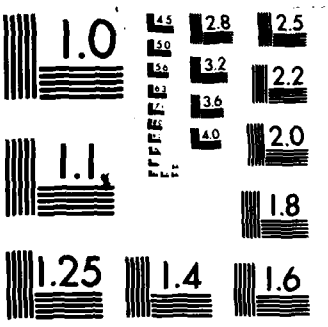

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SHIP
OPERATING
and
SUPPORT

COST ESTIMATING GUIDE

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Office of the Secretary of Defense

Cost Analysis Improvement Group

13 July 1982

OFFICE OF THE SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

OFFICE OF
THE DIRECTOR
PROGRAM ANALYSIS
AND EVALUATION

24 FEB 1984

MEMORANDUM FOR DEFENSE TECHNICAL INFORMATION CENTER

SUBJECT: AD Number: A132442

Enclosed is a revision to the document "Ship Operating and Support, Cost Estimating Guide." Please substitute it for the document now on file at DTIC with the AD number of A 132442.

Geraldine W. Asher

Geraldine W. Asher

PREFACE

This guide was jointly prepared by the OSD Cost Analysis Improvement Group (CAIG) and the several Navy offices concerned with ship cost estimating and analysis and/or the data in the Ships Visibility and Management of Operating and Support Cost (VAMOSC-Ships) Management Information System. This guide is intended for use by CAIG and Navy analysts in preparing ship operating and support (O&S) cost estimates. It replaces the O&S cost structure published in August 1977.

The information provided in this guide should be used for developing estimates of ship O&S costs submitted for 1) DSARC milestone reviews or other OSD Program Reviews and 2) for Navy milestone reviews as appropriate. DSARC milestone review and OSD Program Review can be used interchangeably throughout this guide. Specific questions concerning this guide or cost estimation procedures should be addressed to OSD, Office of the Director(PA&E)RA, Rm 2D278, Pentagon, Washington, D.C. 20301, telephone (202) 697-0317 or OPNAV(96D), Rm 2C340, Pentagon, Washington, D.C. 20301, telephone (202) 697-9997.

MILTON A. MARGOLIS
Chairman
Cost Analysis Improvement Group

CONTENTS

TABLES

ABBREVIATIONS

APA	-	Appropriation Purchase Account
ADP	-	Automatic Data Processing
ASROC	-	Anti-Submarine Rocket
CAIG	-	Cost Analysis Improvement Group
CER	-	Cost Estimating Relationship
DoD	-	Department of Defense
DoDD	-	Department of Defense Directive
DSARC	-	Defense Systems Acquisition Review Council
EPA	-	Extended Planning Annex
ERP	-	Extended Retrofit Period
FMP	-	Fleet Modernization Program
FYDP	-	Five Year Defense Program
HM&E	-	Hull, Mechanical, and Electrical
IMA	-	Intermediate Maintenance Activity
LCC	-	Life Cycle Cost
NARM	-	Navy Resource Model
NAVSEA	-	Naval Sea Systems Command
NSA	-	Navy Stock Account
OSD	-	Office of Secretary of Defense
OPN	-	Other Procurement, Navy
OPNAV	-	Office of the Chief of Naval Operations
O&MN	-	Operations and Maintenance, Navy
O&S	-	Operating and Support
PA&E	-	Program Analysis and Evaluation
POL	-	Petroleum, Oil, and Lubricants
POM	-	Program Objective Memorandum
PPBS	-	Planning, Programming, Budgeting System
RA	-	Resource Analysis
R&D	-	Research and Development
RAV	-	Restricted Availability
RDT&EN	-	Research, Development, Test, and Evaluation, Navy
ROH	-	Regular Overhaul
SE	-	Support Equipment
SCN	-	Shipbuilding and Conversion, Navy
SHAPM	-	Ship Acquisition Project Manager
SIMA	-	Shore Intermediate Maintenance Activity
SRA	-	Selected Restricted Availability
TAD	-	Temporary Additional Duty
TAV	-	Technical Availability
VAMOSC	-	Visibility And Management of Operating and Support Costs
WPN	-	Weapons Procurement, Navy
WRM	-	War Reserve Material

SHIP OPERATING AND SUPPORT COST DEVELOPMENT GUIDE

1.0 INTRODUCTION.

1.1 PURPOSE. This document provides guidelines for preparing and presenting estimates of operating and support (O&S) costs to the OSD Cost Analysis Improvement Group (CAIG) and the Defense Systems Acquisition Review Council (DSARC) and for Navy milestone reviews as appropriate. These guidelines are intended to achieve consistent and effective preparation and documentation of ship O&S cost estimates such that relevant and significant O&S costs to the alternatives presented are highlighted. This guide might also be conceptually useful for other reviews. The guide replaces the CAIG memorandum on Operating and Support Cost Structures dated August 1977.

1.2 AUTHORITY. The foundation for development and review of life cycle cost estimates within the DSARC process is described in DoDD 5000.1 "Acquisition of Major Defense Systems", and DoDD 5000.4, "OSD Cost Analysis Improvement Group". Specifically, DoDD 5000.4 directs the CAIG to:

- Establish criteria, standards and procedures concerning the preparation of cost estimates to the DSARC and CAIG;
- Develop useful methods of formulating cost uncertainty/cost risk information for DSARC review; and
- Work with DoD components to determine relevant costs for DSARC consideration and to develop techniques for identifying and projecting these costs.

1.3 APPLICABILITY. This guidance applies to ship acquisition programs to be reviewed by the DSARC. It is generally applicable to any O&S cost analysis performed during the acquisition process, including cost effectiveness trade-off studies. The guide is generally expressed at the ship level of cost but is equally applicable to developing cost estimates for major ship systems. This guidance is directed at costs used in acquisition program decisions, and are not necessarily the same as total program or budget costs. This guide has been designed to allow the cost analyst freedom in the selection of cost estimating techniques and models, while also satisfying standard conventions.

2.0 O&S COST PERSPECTIVE.

2.1 MAJOR COST CATEGORIES. The major life cycle cost categories for a system are listed in Table 1. This guide addresses only the O&S category.

2.2 RELEVANT COSTS. This guide centers on the major system acquisition programs to be reviewed by the DSARC. Accordingly, the relevant costs are those that can be affected by OSD and Navy actions during the DSARC process. The objective is to specify all relevant and significant O&S costs to the program decision at hand, regardless of how or when such costs are funded (e.g. appropriation type).

LIFE CYCLE COST
RESEARCH AND DEVELOPMENT
PROCUREMENT
OPERATING AND SUPPORT
DISPOSAL

Table 1. Major Life Cycle Cost Categories

2.3 THE NORMATIVE APPROACH. O&S cost estimates presented to the DSARC should focus on the costs likely to be incurred by a system under specified conditions. They are not designed to estimate future budget expenditures directly. The difference is important. A budget estimate may contain other costs not affected by the DSARC decision, such as, distribution of fixed overhead. The normative approach used here attempts only to estimate the future resource requirements relevant to the decision under consideration, given certain assumptions about the characteristics of the ship, the tactical doctrine for deployment, the maintenance and support policies, the projected tempo of operations, etc.

The normative approach requires more than a projection of historical cost trends. It should provide a logical link between the assumptions about the ship, specified conditions, and the resulting cost estimate. These cause and effect relationships are crucial. If an assumption is changed, either the cost estimate should change, or the lack of change should be explained.

2.4 RELATIONSHIP TO PLANNING, PROGRAMMING, AND BUDGETING. Cost estimates used in the planning, programming, and budgeting process address the total cost to operate the DoD. On the other hand the cost analysis described in this guide pertains only to those portions of total costs that are affected by an acquisition program. Thus the estimated O&S costs may not be the same as programming or budgeting

costs. However, many of the cost elements from these O&S cost analyses should be compatible with approved Program, Planning, and Budgeting System (PPBS) costs, and can be used to derive the impact of alternative ship decisions on programs and budgets.

3.0 ANALYSIS TASKS.

3.1 DEFINING THE PERTINENT ISSUES. Each acquisition program is likely to entail special cost issues and problems. The analyses and presentations for the DSARC should be tailored to deal effectively with them. A recommended method to insure all pertinent issues are identified is through pre-DSARC meetings between representatives of the CAIG and the Navy sponsor, program manager, and cost analysis group. These pre-DSARC discussions may cover:

- Characteristics and operating description of the proposed ship and its major systems;
- Characteristics and operating description of an existing or composite reference ship and its major systems or weight groups;
- Specification of alternatives;
- Identification of historically relevant O&S cost drivers for the reference system(s), and significant differences for the proposed system;
- Identification of the unique properties, characteristics, and/or operating considerations of the proposed ship that could affect O&S requirements including unique operator skills and/or training, special onboard maintenance requirements, special shore maintenance requirements, repair parts stocks, unique operations that may require special considerations, i.e., two crews, special backup crew members, merchant crews, etc;
- Identification of how risk and/or uncertainty is to be handled;
- Specification of content and ground rules for the cost evaluation and its presentation, including determination of costs to be included or excluded for the decision at hand; and
- Specification of significant trade-off issues to be quantified and presented.

3.2 IDENTIFYING THE REFERENCE SHIP AND ITS MAJOR SYSTEMS. To provide the required contemporary baseline against which to compare the cost of a proposed ship, a reference class of ships, ship subsystem or composite drawn from several types/systems should be identified. A reference system is an existing operational system with an historical cost data base (e.g. the Visibility and Management of Operating & Support Costs .

(VAMOSC) Management Information System) and a mission similar or analogous to that of the proposed system. The reference ship and major systems may be a composite of major systems and/or weight groups from several like ships or other systems. This composite reference will include propulsion, auxiliary machinery/electrical plant and weapons combination of gun, missile, fire control, and launching subsystems, including appropriate operator and maintenance manpower and off-ship maintenance and support requirements. The ship being replaced may itself be the reference system, or a newer ship class that provides a better point of reference or more accurate data for the analysis.

The normative approach is also applied to the reference ship. The assumptions and cost estimating methods for both the reference and proposed ship should be similar. Differences in conditions (e.g. operating profile and/or projected tempo, manning policies, etc.), should not obscure differences in ship characteristics affecting resource needs.

3.3 DEFINITION OF ANALYSIS GROUND RULES. A prerequisite to the development of useful O&S cost estimates is a detailed definition of how the ship and its major systems will be operated, maintained, and supported in peace and war. The analysis groundrules should be defined from this information. The groundrules definition should include descriptions of relevant missions, characteristics, as well as manning, maintenance, support, and logistic policies. The documented ground rules should furnish the information needed to allow proper interpretation of the cost estimates. These ground rules should be assembled for convenient reference and included as part of the estimate documentation. The basis for determining major O&S costs, such as the projected number of ship's officers and enlisted men, steaming hours, fuel consumption and maintenance support levels should be compatible with the stated O&S requirements and concepts. In addition, they should be compatible with other ground rules used for determining non-O&S cost elements, such as initial spares, support equipment, and war reserve material.

3.4 SELECTING THE RELEVANT COSTS. A cost element structure establishes a standard vocabulary for identifying and classifying the costs for decision making purposes of a ship and its major systems. The recommended O&S cost structure is discussed in Section 5.

The cost structure discussed in Section 5 is intended to reasonably cover the O&S costs for the DSARC. However, research may introduce circumstances for which additional costs may also be relevant. For example, collateral costs for such activities as base openings could be pertinent to some ship acquisition programs. Therefore, it is very important to insure that any unique costs are addressed, and a check should be made to determine if all relevant costs are included. If a decision will affect costs not explicitly described in this guide, such costs should be identified, estimated, and included in the cost analysis.

3.5 CONSTRUCTING THE COST MODEL. Specific models or techniques for calculating O&S cost are not prescribed in this guide. There are several acceptable ways of generating O&S cost estimates and no one approach is best for all situations. In general, the context of the problem determines the estimating process. Context includes the phase of the acquisition program, the decision to be made, and the accuracy and resolution required in the estimate. A good model will have the following characteristics:

- Reliable Data Base. The data base used must be known to be reliable. The VAMOSC-Ships data base is currently the best source for most ship O&S costs. When other data are used a test for reliability must be undertaken.

- Consistency in the Cost Structure. The basic cost structure should not change as the program progresses through the acquisition process. However, the basic elements and their subelements should progress to greater levels of detail. For this reason, the cost structure provided in this guide is hierarchical, e.g., the sum of each set of lower indenture elements equals the next higher indentured element. In this manner, the cost structure allows flexibility in selection of the level and method by which an element is estimated.

- Consistency in Data Elements. The data elements must be consistent with like elements for operating systems for which actual data exists. This allows the proposed ship to be directly compared to the reference systems costs and cost driving parameters. As discussed above, the data should be derived from the most reliable or credible data base for a given cost element. However, this does not mean that the same data source has to be used for all data elements, only that they should be consistent within data elements.

- Flexibility in Estimating Techniques. An estimating model should allow the element estimating techniques to vary as the program progresses through the acquisition phases. For example, at Milestone I, it may only be possible to estimate major elements of cost using a statistical cost estimating relationship (CER). However, at Milestone II, more detailed information should be available. Some of these elements may be developed by engineering analysis and others by CERs. Generally, by the production review, design sensitive parameters will need to be developed by engineering analysis in order to address the issues normally raised at this review.

- Simplicity. Complexity is not a desirable trait in an O&S cost model. The cost, labor hours, and schedule required to setup and provide data for a complex model may prohibit its effective and timely use in the decision process. The model should be structured so that it is useful in the early phases of the acquisition process and can evolve to accommodate more information as the program continues through the acquisition phases.

- Usefulness to the Design Process. While the estimation of costs for DSARC review is an important function, the application of the model to the day-to-day program office and contractor decision processes is equally important. The feedback to the design, operational, and support decision processes is the primary means to minimize life cycle cost. Consequently, the methodology used for review must be responsive to design and operational changes and must take into account relevant design and operational factors (e.g. reliability, maintainability, operating tempo).

3.6 ESTIMATING AND EVALUATING RELEVANT COSTS. The analysis and evaluation of O&S costs during the DSARC review is vital to the selection, improvement, and control of design, development, maintenance, and support concepts for the proposed ship. The purpose of the O&S cost analysis is to explore and quantify the relative advantages of different concepts and design options (for example, the comparison of new and old systems, alternative maintenance and support policies, etc.). A fundamental consideration in the DSARC process is that the proposed ship satisfy its mission requirements at the lowest total life cycle cost.

The O&S cost analysis may also provide a means of estimating the impact of O&S costs upon affordability and force structure planning (e.g., the POM, FYDP, and EPA processes). Such extensions of this O&S cost analysis must, however, be viewed as a cost delta where the increase or decrease from some reference cost may be useful. (Caution must be exercised in such an application.)

3.7 TREATING UNCERTAINTY. Estimates of future ship O&S costs are beset by uncertainties from many sources. It is therefore useful to perform sensitivity analyses that show the magnitude of the uncertainty and explain the method used to establish the bounds of the range. When cost estimating techniques permit, sensitivity analyses can also be useful in treating uncertainty on selected cost elements. When either of these approaches is taken, the cost value associated with the most likely outcome should be bounded by the least costly and most costly conditions. When quantification of uncertainty proves impractical, a qualitative assessment of the variation should be made.

The DSARC should also be shown the major risks of the acquisition program, their likely impact on O&S costs, and where appropriate feasible alternatives. For example, an O&S cost estimate is frequently sensitive to the goals established for reliability and maintainability of the ship and selected subsystems. If fulfillment of these goals is uncertain during the development phase, the cost impact and sensitivity of degraded reliability and maintainability should be investigated, and, if significant, presented to the DSARC.

4.0 MAJOR CONVENTIONS.

4.1 INTRODUCTION. This section discusses some of the conventions to be used in developing and presenting O&S costs to the DSARC. Deviations should be coordinated with the CAIG.

4.2 COST ESTIMATE COVERAGE. Cost estimates may be required for a single ship, an annual buy of ships, and/or the total shipbuilding program. The estimates will normally include both the annual cost per ship and the O&S costs throughout the expected economic service life of the ship(s) and its major systems.

4.2.1 Annual Ship Costs. Analysis will include the average annual cost per ship for operating, maintaining, and supporting the ship equipped with its proposed major systems. For the purposes of the estimate, mature ship conditions should be assumed.

4.2.2 Ship Service Life Costs. Analysis will include the O&S cost over the appropriate expected economic service life of the ship. Weapon loadouts may or may not be included as appropriate to the decision. The airwing costs for aircraft carriers may or may not be included, but if included must cover the same economic service life as the ship.

4.2.3 Total Ship Program O&S Costs. When relevant, total ship program O&S costs may be requested. When so considered individual ship O&S costs should be time phased over the requested period and this analysis should consider the phase-in of the ships to the active and reserve forces and the phaseout or retirement of replaced ships. Normally mature ship conditions should be considered for individual ships.

4.3 WAR/PEACE CONDITIONS. The O&S cost estimates should be based on projected peacetime operations. The scenario that best reflects the expected utilization and support of the proposed ship and generates the most likely O&S resource requirements should be used. It should be noted that while peacetime operations may be assumed, some cost elements are maintained during peacetime to meet wartime requirements. Manning levels are an example of this.

4.4 O&S PERIOD. The O&S cost analysis should extend over the expected useful life of the ship (ie, its economic service life). Generally, this is 30 to 45 years of operation. The expected economic service life used for a particular program should be the normally used value for that ship type, or if different should be coordinated with the CAIG.

4.5 TYPE OF DOLLARS. For DSARC reviews O&S costs must be presented in constant dollars of the current fiscal year. Any sensitivity of estimates to discounting and escalating cost streams must be presented separately.

4.6 CONTINUITY. Costs should be traceable to those submitted in previous CAIG reports on the ship. Significant changes in the program, assumptions, cost driving parameters, etc, as well as cost growth should be explained.

4.7 MATURE SYSTEM ASSUMPTIONS. While the actual O&S characteristics of a ship do change throughout its lifetime, when estimating typical annual O&S costs (i.e. a snapshot of one year's O&S costs), a mature ship should be assumed. The characteristics of the mature ship are those most likely to occur during projected operational use. (Note: In some cases, they may not be the same as the design goals).

If however, when total shipbuilding program O&S costs are requested and the phase-in costs are being considered it may be relevant and appropriate to also consider variable items as contractor support in the early years and/or reliability and maintainability growth if appropriate to the decision being considered. Different rates of maturity may also be significant when comparing alternatives that differ markedly in their use of common subsystems, in the efforts devoted to finding and correcting design or support weaknesses, in the support strategies for the early years of ship operations, and in the rates at which operating experience is gained.

4.8 SIGNIFICANT COST ELEMENTS. Not all of the cost elements require or deserve the same attention. The greatest analytic effort should be devoted to those accounting for a substantial part of the total O&S costs, those that can be affected by acquisition program decisions, or those that assist in distinguishing between alternatives. For example, the significant O&S cost elements are normally manpower (both operator and ship maintenance), fuel, depot maintenance, and to a lesser extent, shipboard spare parts and other organizational material and recurring investment. Cost elements not pertinent to distinguishing between alternatives and not relevant for another reason may be addressed using planning factors.

4.9 EXCLUDED COSTS.

4.9.1 Research and Development. All R&D costs are excluded; such as those incurred in developing the design of the new ship, components and support equipment, and costs associated with the development and test of the new ship through the end of the acquisition process.

4.9.2 Procurement and Modernization. Initial SCN ship procurement costs, SCN modernization costs, and SCN service life extension costs are all excluded. (Such costs are included in the Procurement category regardless of when they are funded and become a part of life cycle costs.)

Annual OPN and WPN purchases and related O&MN procurement cost for: reparable material, government furnished material for the Fleet Modernization Program (FMP) and conventional training missiles and munitions,

and other procurement costs that are the result of operating the ship and ship systems are not excluded. See section 5.0.

4.9.3 Disposal. Ship decommissioning and disposal costs at the end of the economic service life are excluded from O&S costs.

5.0 O&S COST ELEMENT STRUCTURE.

5.1 INTRODUCTION. To establish consistency in the computation and display of costs, the desired cost estimating structure for ship O&S costs is provided in Table 2. This structure is designed specifically for DSARC decision needs when reviewing ship acquisition programs, and not necessarily for programming or budgetary analysis. Definitions of the elements are provided in this section to gain a better understanding of the cost elements. (NOTE: The level of detail does not imply that the costs have to be broken out to the level of indenture shown in the subsequent tables for all analyses. The lower more detailed indentures should be estimated and presented as relevancy dictates and estimating techniques permit.)

The structure is based on the Ships VAMOSC structure and reflects those costs associated with an individual ship. The definitions contained in this section may require modification if this guide is applied to ship systems. Suggested deviations should be coordinated with the CAIG.

In addition to the O&S cost estimating structure displayed in Table 2, other non-cost data may be required in order to meet DSARC requirements. This data is discussed in Section 6 and is primarily concerned with maintenance and tempo of operations.

SHIP OPERATING AND SUPPORT COSTS

- DIRECT UNIT COST
  - Personnel
    - Officers
    - Enlisted
    - Civilian
    - Temporary Additional Duty
  - Ship Fuel
    - Conventional Fuel
    - Nuclear Fuel
  - Repair Parts
  - Supplies
  - Training Expendable Stores
  - Purchased Services
- DIRECT INTERMEDIATE MAINTENANCE
  - Labor
  - Material
- DIRECT DEPOT MAINTENANCE
  - Regular Overhaul
  - Selected Restricted Availability
  - Restricted Availability
  - Technical Availability
  - Component Repair
  - Other Depot
- SUSTAINING INVESTMENT
  - Organizational Issues
  - Fleet Modernization
  - Software Support
- INDIRECT OPERATING AND SUPPORT
  - Base Operations
  - Health Activities
  - Recruiting & Examining Activities
  - Training
  - Permanent Change of Station
  - Logistics

Table 2. Ship Operating and Support Cost Elements

5.2 DIRECT UNIT COSTS. The following paragraphs present the definitions for Direct Unit Cost elements as displayed in Table 3.

DIRECT UNIT COST

- Personnel
  - Officers
  - Enlisted
  - Civilian
  - Temporary Additional Duty
- Ship Fuel
  - Conventional Fuel
  - Nuclear Fuel
- Repair Parts
- Supplies
  - Equipment/Equipage
  - Consumables
  - Ships Force Material
- Training Expendable Stores
  - Ammunition
  - Other Expendables
- Purchased Services
  - Printing and Reproduction
  - ADP Rental and Contract Services
  - Utilities
  - Communications
  - Other

Table 3. Direct Unit Cost Elements

5.2.1 Personnel. Identifies the direct personnel cost at the organizational (ship) level. This is the cost of pay and allowances for personnel assigned to the ship. It includes the ship's complement necessary to meet combat readiness, training, and administrative requirements. This element excludes the personnel in squadrons or detachments which are assigned to the vessel and complement its mission.

An often overlooked, but fundamentally significant consideration are unique personnel costs. If any unique skills and/or training will be required for one ship manning and a different level for an alternative, then these unique manpower needs must be addressed and their costs included as add on items for any of the personnel models selected.

The personnel costs should be based on manning levels and skill categories vice the cost per hour. Reducing maintenance manhours does not necessarily decrease cost even though a reduction in manhours may have other potential benefits (e.g. increased readiness). Any benefits

of manhour reductions should be separately identified.

5.2.1.1 Officers. The officers portion of the personnel cost.

5.2.1.2 Enlisted. The enlisted portion of the personnel cost.

5.2.1.3 Civilian. The civilian portion of the personnel cost.

5.2.1.4 Temporary Additional Duty Pay. This is the cost of ship's personnel travel for training, administrative or other purposes such as Homeport Travel Entitlement, Special Aircraft Charter, Temporary Shore Patrol, and Crew Rotation/Deployment. It consists of costs such as commercial transportation charges, rental of passenger carrying vehicles, mileage allowances, and subsistence for travelers which include per diem allowances and incidental travel expenses.

5.2.2 Ship Fuel. Identifies the cost of fuel consumed for propulsion and normal peacetime ship service.

5.2.2.1 Conventional Fuel. The cost of all petroleum, oil, lubricants (POL), and fuel additives consumed by the ship for operations and maintenance. It includes the cost of fuel consumed by the ship while underway and when it is not underway as well as the cost of POL used for other than ship's propulsion and ship's services (e.g. lubricants, hydraulic oils, and fuel for portable gasoline powered equipment). Note: This element does not include fuel for flying operations. POL for flying operations is chargable to the aircraft, not the ship.

5.2.2.2 Nuclear Fuel. The nuclear fuel consumption (burn-up) charge for the fuel (uranium) usage. (Note: In developing LCC for a nuclear powered ship, care should be taken to avoid double accounting of costs since the cost of acquiring and installing the initial and replacement core(s) is included in the procurement cost, SCN or OPN.)

5.2.3 Repair Parts. The cost of repair parts procured from the Navy Stock Account (NSA) for use in maintenance of the ship and installed equipments. It includes items reported under the 3-M data system, plus all other repair parts consumed in maintenance actions.

5.2.4 Supplies. The cost of those supplies which are neither Appropriation Purchase Account (APA) Material reported under Direct Recurring Investment, nor repair parts. It includes all non-maintenance supplies and equipage used by the ship and the ship's crew. Examples include items relating to the health, safety and welfare of the crew, such as medical and dental supplies, radiation badges, fire protection suits, charts, maps, binoculars, and clocks, etc.

5.2.4.1 Equipment/Equipage. The cost of all Navy Stock Account (NSA) type items that are not classified as consumables or repair parts. Specifically included are non-Appropriation Purchase Account (APA) items of

equipment/equipage which require management control afloat due to any one of a combination of high unit cost, vulnerability to pilferage and/or essentiality to ship's mission. Examples include binoculars, electronic test equipment, etc.

5.2.4.2 Consumables. Costs for supplies which are ordinarily consumed or expended within one year after they are put into use and are not specifically included in other elements. Includes administrative and housekeeping items, medical and dental supplies, routine maintenance tools not specifically related to, but which may be used in the repair of equipment and equipage and general purpose hardware. Consumable material used for accomplishing maintenance actions is included under Repair Parts.

5.2.4.3 Ship's Force Material. The cost of material consumed by the ship's force during the ship overhaul.

5.2.5 Training Expendable Stores. The costs associated with expendable stores, consumed by the ship, which are purchased from procurement appropriations.

5.2.5.1 Ammunition. The cost of ammunition, training missiles, and pyrotechnics expended by the ship in non-combat operations (such as fire power demonstrations) and training exercises.

5.2.5.2 Other Expendables. The cost of those expendables which are consumed by the ship and not reported in the previous element. It includes Polaris/Poseidon missile training firings, sonobouys expended, etc.

5.2.6 Purchased Services. The cost of non-maintenance purchased services.

5.2.6.1 Printing and Reproduction. The direct cost incurred by the ship for procurement of printing and publications not carried in standard government stocks.

5.2.6.2 ADP Rental and Contract Services. The cost of rental of automatic data processing equipment and related contractual services.

5.2.6.3 Utilities. The cost of heat, light, power, water, gas, electricity, and other utility services.

5.2.6.4 Communications. The cost of long distance telephone and teletype services, postage (other than parcel post), rental of post office boxes, and telephone installation charges.

5.2.6.5 Other. Cost of services purchased by the ship and not covered elsewhere. It includes laundry services, rental of boats and port services which are provided by other than Navy activities.

5.3 DIRECT INTERMEDIATE MAINTENANCE. The cost of material and labor expended by a shore or afloat Intermediate Maintenance Activity (e.g. tender or repair ship) in the repair and alteration of a ship or its systems.

5.3.1 Maintenance Labor. The cost of labor expended on the repair and alteration of the ship.

5.3.2 Material. The costs of repair parts and consumables used in the repair or alteration of the ship. This element includes the cost of NSA type repair parts that appear in an allowance list, that are used in the repair and alterations of the ship, and its installed and assigned equipments.

5.4 DIRECT DEPOT MAINTENANCE. Table 4 displays the elements included in Direct Depot Maintenance. These elements are defined in the following paragraphs. Some of the following depot maintenance actions will occur at intervals ranging from several months to several years. The most useful method of portraying these costs is on an annualizied basis (e.g. cost per ship per year).

DIRECT DEPOT MAINTENANCE

- Regular Overhaul
  - Labor
  - Material
- Selected Restricted Availability
  - Labor
  - Material
- Restricted Availability
  - Labor
  - Material
- Technical Availability
  - Labor
  - Material
- Component Repair
  - Organizational Exchanges
  - Depot Exchanges
- Other Depot
  - Rework
    - Ordnance Rework
    - HM&E Rework
    - Electronic Rework
  - Other

Table 4. Direct Depot Maintenance Cost Elements

5.4.1 Regular Overhaul. The cost of scheduled Regular Overhauls (ROH) performed by both public and private shipyards. It includes costs of complex overhauls, interim overhauls, and also conversions. Fleet Modernization Program (FMP) work performed at private shipyards is included.

5.4.1.1 Labor. The shipyard labor portion of the regular overhaul cost.

5.4.1.2 Material. The shipyard material portion of the regular overhaul cost.

5.4.2 Selected Restricted Availability (SRA). The cost of SRA's performed by both public and private shipyards. It also includes costs for Extended Selected Restricted Availability, Incremental SRAs and Extended Refit Period (ERP) for SSBNs.

5.4.2.1 Labor. The shipyard labor portion of the SRA costs.

5.4.2.2 Material. The shipyard material portion of the SRA costs.

5.4.3 Restricted Availability (RAV). The costs of non-scheduled depot level ship repair which requires the ship to be present at the facility.

5.4.3.1 Labor. The facility labor portion of RAV cost.

5.4.3.2 Material. The facility material portion of RAV cost.

5.4.4 Technical Availability (TAV). The cost of non-scheduled depot level ship repair which does not require the ship to be present at the facility and does not affect the ships ability to perform its mission.

5.4.4.1 Labor. The facility labor portion of TAV cost.

5.4.4.2 Material. The facility material portion of TAV cost.

5.4.5 Component Repair. The cost of depot labor and material used in the repair of repairable components. These items are removed and replaced and the faulty component returned to the appropriate depot for repair.

5.4.5.1 Organizational Exchanges. A prorata share of repair costs incurred as a result of receiving repairable APA material on an exchange from supply or centrally managed equipment sources.

5.4.5.2 Depot Exchanges. The repair cost of repairable APA material exchanged during a ships depot availability.

5.4.6 Other Depot. The costs of depot maintenance not included in previous elements.

5.4.6.1 Rework. The costs of the depot overhaul, rework or repair of major equipments.

5.4.6.1.1 Ordnance Rework. The cost of depot overhaul, rework or repair of major ordnance equipment. These include ASROC launchers, gun mounts, torpedo tubes, other missile launchers and other miscellaneous ordnance equipments.

5.4.6.1.2 Hull, Mechanical and Electrical (HM&E) Rework. The cost of depot overhaul, rework or repair of HM&E equipment. Included are propellers and shafts, gas turbine engines, electrical generators, navigation equipment and other miscellaneous equipments.

5.4.6.1.3 Electronic Rework. The cost of depot overhaul, rework or repair of major electronic equipment. Included are Navy Tactical Data System (NTDS) equipment, Ships Inertial Navigation System (SINS) equip-

ment and submarine periscopes.

5.4.6.2 Other. Other depot costs of selected equipments as applicable to the ship being considered. Included are Naval Air Rework Facility (NARF) repair of catapults, arresting gear, and landing aids, and Field Change Installation by Naval Electronics System Command personnel.

5.5 SUSTAINING INVESTMENT. The following paragraphs define the elements shown in Table 5.

SUSTAINING INVESTMENT

Organizational Issues

Fleet Modernization
- Labor
- Funded Material
- Government Furnished Material
- Other Fleet Modernization

Software Support

Table 5. Sustaining Investment

5.5.1 Organizational Issues. The prorata share of replenishing APA spares stocks as a result of condemning repairable APA material as beyond economical repair and other loses.

5.5.2 Fleet Modernization. The cost of installing ship alterations and improvements including military and technical improvements, nuclear alterations, ordnance alterations, conversion, and other support provided at public facilities. Private shipyard costs for conversion and fleet modernization work are included whenever these elements can be identified.

5.5.2.1 Labor. The shipyard or depot labor costs to install fleet modernization items.

5.5.2.2 Funded Material. The shipyard or depot cost of material procured for performing the fleet modernization task.

5.5.2.3 Government Furnished Material. The government cost of Special Program Material procured from the Appropriations Purchase Account (APA) used by or installed in a ship during depot installation of fleet modernization alterations.

5.5.2.4 Other Fleet Modernization. The cost of installation of material and services procured for a ship by organizations other than the installing shipyard. This includes costs for planning, adaptive design, procurement of long leadtime incidental material and prefabrication. It also includes an allocation of total costs expended for fleet modernization which are not relatable to a specific ship. All material included is funded non-investment material.

5.5.3 Software Support. The costs of supporting and upgrading computer software in the operational phase.

5.6 INDIRECT OPERATING AND SUPPORT COST. The cost of other services and non-investment items that are required during the service life of the ship but are not directly relatable to a particular ship and are relevant to the alternatives being considered. (Normally these indirect O&S costs may be excluded when comparing among similar alternatives.) Generally these are the costs which would be directly affected by a significant change in the number of ships in the overall Navy force level. This is a necessarily subjective judgement and is valid only within a certain probable range of force levels. For example, a tripling of ship force levels would necessitate an increase in the size of fleet headquarters staffs; however, within the range of probable Navies, the fleet headquarters staff would not vary with ship forces and would therefore not normally be included as an indirect support cost.

Unless indirect O&S cost element details are relevant and significant to a particular decision they may be addressed using standard planning factors (e.g. NARM factors) or personnel billet cost model concepts. The following indirect O&S cost elements include Operations & Maintenance (O&M) and Military Pay appropriations as appropriate. If the Billet Cost Model is employed the analyst should determine which of the following elements are included in the personnel cost, and estimate the relevant and significant elements not included (e.g. logistics and base operations) on another basis.

5.6.1 Base Operations. The cost to maintain the bases out of which the ship operates. It includes the primarily active and reserve bases, public works centers, commissary stores, and exchanges.

5.6.2 Health Activities. The cost to operate medical facilities that treat the personnel assigned to a particular type of ship.

5.6.3 Recruiting & Examining Activities. The cost to operate facilities used to either recruit or examine prospective Navy enlisted entrants who will occupy a particular ship type.

5.6.4 Training. The cost to operate and maintain training facilities needed to train personnel to occupy a particular type of ship.

5.6.5 Permanent Change of Station. The cost to move personnel assigned to staff or support positions for a ship of a particular type.

5.6.6 Logistics. Other logistic support costs that can be allocated back to a particular ship. These O&M funds are used for such things as publications replenishment, test equipment maintenance, second destination transportation, engineering & technical services, etc.

6.0 DOCUMENTATION.

6.1 INTRODUCTION. The objective of the cost documentation is to provide a concise, results oriented presentation of the key points of the cost analysis in such a manner as to direct the attention of the DSARC principals and senior DOD and Navy officials to the O&S cost impacts of the decisions they are considering. The documentation should be organized for rapid examination to permit a detailed review of the assumptions, cost estimating methods, data sources, and rationale supporting the analysis. Each cost element should be sufficiently documented for verification as to reasonableness by a competent analyst using the same assumptions, methods, and data. The cost element documentation should include a:

- Definition of the cost element when it differs from the definition contained in this guide;
- Description of the derivation;
- Record, both narrative and mathematical, of the expression used to derive its value;
- Description of the bounds within which the expression applies (pertinent assumptions must be noted explicitly);
- Definition of each input variable;
- List of values assigned to input variables; and
- Discussion of the derivation of individual values (particularly reliability and maintainability measures). In addition to identifing the specific data source, any adjustments made to the data source including reasons and justification for the adjustments should be documented.

6.2 NON-COST DATA ELEMENTS. To complement the costs, significant cost deriving/driving factors should also be displayed. The following paragraphs describe some of these non-cost elements. The elements, which are shown in table 6, may be documented with the appropriate costs or as a separate section.

NON-COST DATA ELEMENTS

- Personnel - Navy
  - Officer
  - Enlisted
- Personnel - Aviation
  - Officer
  - Enlisted
- Personnel - Marine
  - Officer
  - Enlisted
- Personnel - Unique Considerations
- Steaming Hours
  - Steaming Hours Underway
  - Steaming Hours Not Underway
- Barrels of Fuel Consumed
  - Fuel Consumed Underway
  - Fuel Consumed Not Underway
- Labor
  - Organizational Maintenance
  - Intermediate Maintenance
  - Regular Overhaul
  - Selected Restricted Availability
  - Restricted Availability
  - Technical Availability
  - Fleet Modernization Program

Table 6. Non-Cost Data Elements

6.2.1 Personnel.

6.2.1.1 PERSONNEL - Navy. The average number and grade by officer and enlisted of Navy personnel onboard for duty.

6.2.1.2 PERSONNEL - Aviation. The average number and grade by officer and enlisted of aviation support personnel onboard for duty that are not directly assigned to the aviation squardron/detachment (ie the AIMD personnel).

6.2.1.3 PERSONNEL - Marine. The average number and grade by officer and enlisted of Marine Corps personnel onboard for duty.

6.2.1.4 PERSONNEL - Unique Considerations. Unique manpower needs such as special skills or training or the use of critical occupations should also be identified.

6.2.2 Steaming Hours.

6.2.2.1 Steaming Hours Underway. The projected annual number of hours that the ship will be using its main propulsion for underway operations or training.

6.2.2.2 Steaming Hours Not Underway. The projected annual number of hours the ship will be using its main power system alongside the pier or at anchor.

6.2.3 Fuel Consumed.

6.2.3.1 Barrels of Fuel Consumed Underway. The projected annual barrels of fuel consumed by a conventional ship while underway for operations or training.

6.2.3.2 Barrels of Fuel Consumed Not Underway. The projected annual number of barrels of fuel consumed by a ship while alongside the pier or at anchor.

6.2.4 Labor Manhours.

6.2.4.1 Organizational Maintenance. The manhours expended by the ships force on reported organizational corrective maintenance.

6.2.4.2 Intermediate Maintenance. The labor manhours expended by a tender, repair ship or ashore IMA activity on the repair or alteration of the ship or its systems.

6.2.4.3 Regular Overhaul. The mandays of labor expended on Regular Overhaul by the ROH shipyard.

6.2.4.4 Selected Restricted Availability. The mandays expended on Selected Restricted Availability by the SRA shipyard.

6.2.4.5 Restricted Availability. The mandays expended on Restricted Availability by the RAV facility.

6.2.4.6 Technical Availability. The mandays expended on Technical Availability by the TAV facility.

6.2.4.7 Fleet Modernization Program. The mandays expended on the Fleet Modernization Program by the FMP shipyard.

6.3 TAILORING DOCUMENTATION. Documentation of O&S analysis can be tailored to the acquisition program phase. Sample O&S analysis and documentation have been prepared by the CAIG for various type systems at various program phases and are available from the CAIG upon request. A ship example is provided as attachment 1. The example is provided to assist in the preparation of O&S cost estimate reports and does not imply a preference for one analysis technique or data base over another nor does it dictate the cost structure and associated level of detail.

Operating and Support Cost Estimates for Navy V/STOL Capable Destroyer

DSARC II

1 November 1980

Prepared for:
Office of the Secretary of Defense
Cost Analysis Improvement Group

Attachment 1

FORWARD

DOD Directive 5000.4 "OSD Cost Analysis Improvement Group", provided the charter for the Cost Analysis Improvement Group (CAIG) to review and establish criteria, standards, and procedures concerning the preparation and presentation of cost estimates on defense systems to the DSARC and CAIG. In support of this objective, the CAIG has periodically issued guidance for development and presentation of Operating and Support (O&S) costs for OSD review. To date general draft guidance has been made available for aircraft, ships, and ground combat vehicles.

In consonance with that general guidance, the following sample of a CAIG Operating and Support Cost Estimate Report covering a hypothetical case has been developed to further assist the cost analyst in the preparation of cost estimating reports submitted to the DSARC and CAIG during the acquisition process of a new weapon system.

This sample is not intended to imply the existence of a specific acquisition program. Nor does it imply a preference for one analysis technique over another. The sample illustrates how Operating and Support costs can be developed for CAIG review with available data bases and one example of an appropriate format for presentation of cost estimates.

The existing DD963 and fictional class ship data were used only to illustrate the need to relate an estimate to an existing similar system and to ensure a consistant relationship between values and the Cost Element Structure. It is not used to promulgate the use of specific data bases. Each case should address those data which are the most complete and accurate for its purposes. Further, the level of detail depicted in this example may be greater or less than that which is available or appropriate to a specific case.

The sample is designed to complement the Cost Analysis Improvement Group's Ship Cost Development Guide. Jointly, these two documents can provide the basis for a program manager to develop a cost estimate that is acceptable for CAIG review.

EXECUTIVE SUMMARY

Operating and Support (O&S) costs for the V/STOL and Spruance class destroyers (DD963) are shown below. These figures are compared to the figures presented to the DSARC at Milestone I. Annual operating and support costs of the Air Detachment are not included in this report . . . .

DSARC I to DSARC II Comparison
FY 80 $ - Millions, 1 Ship/yr (less Air Detachment)

Ship	DSARC I	Current Estimate	Remarks
DD963	$14.0	$15.6	Increase in POL and reported data base
V/STOL Destroyer	$16.1	$17.2	Increase in POL & manning costs and increase in data base

The costs growth reflected in both the V/STOL and DD963 class destroyer is due mainly to the rise in POL costs from $1.25 per gal. to $1.32 per gal., plus a slight rise in manpower requirements . . . .

The Spruance class destroyer was selected as the baseline due to similarities of most ship systems and size. It does not reflect the system being replaced. The V/STOL destroyer is a new concept to meet expanding commitments to . . . .

GUIDANCE: THE EXECUTIVE SUMMARY IS A SIMPLE ONE PAGE NARRATIVE PROVIDING THE BOTTOM LINE COSTS, FORCE SIZE AND MAJOR COSTS DRIVERS, AND ASSUMPTIONS. INCLUDE A BRIEF EXPLANATION OF DIFFERENCES PREDICTED FROM THE BASELINE SYSTEM AND THE DSARC MILESTONE I COST ESTIMATIONS.

CONTENTS

CONTENTS

1. INTRODUCTION

The following cost analysis report is submitted in support of Defense Systems Acquisition Review Council (DSARC) Milestone II review of the V/STOL Destroyer program . . . . All values included in this report are in FY 80 dollars unless indicated otherwise . . . . The operating and support costs of the Air Detachment are not included in this report . . . .

GUIDANCE: IDENTIFY THE MILESTONE, MISSION ELEMENT NEEDS STATEMENT (MENS), AND DECISION COORDINATING PAPER (DCP) WITH DATE AND THE BASE YEAR FOR COSTS.

In consonance with the Sea-Based Air (SBA) Master Plan, development of a V/STOL capable destroyer, able to provide for the rapid dispersal of a naval force's close air support capability while offering full support and flexibility to the Navy's sea control and projection missions, is planned . . . .

GUIDANCE: INCLUDE A SHORT STATEMENT SUMMARIZING THE MENS/DCP AND ANY SIGNIFICANT DEVIATIONS THAT THE COST ANALYSIS MAKES FROM THE DOCUMENTS.

The objective of this program is to provide a V/STOL destroyer capable of performing sea control and projection missions, and able to survive in the combat environment of the 1990's and beyond . . . .

The program uses the basic hull and propulsion unit of the Spruance class destroyer with a V/STOL aircraft landing area and hangar on the ship's stern . . . . Use of a proven hull design and many existing ship's subsystems (See Table 3) provides a firm foundation on which to base the Operating and Support cost estimates . . . .

GUIDANCE: ALSO, OUTLINE THE PROGRAM, ITS STAGE OF DEVELOPMENT, MAJOR SYSTEM PARAMETERS, AND MAJOR POTENTIAL RISKS THAT IMPACT OPERATING AND SUPPORT (O&S) COSTS.

Table 1 presents the Operating and Support (O&S) costs from Appendix B (C) for the baseline ship (DD963) and the proposed V/STOL capable destroyer . . . .

In Table 2 the cost estimates presented at DSARC I are tracked to the current estimate and reasons for significant variances given . . . .

GUIDANCE: THE TABLE LISTING THE O&S ANNUAL COSTS FOR A TYPICAL SHIP SHOULD REFLECT THE COST ELEMENT STRUCTURE (CES)

ARRIVED AT THROUGH CONSULTATION WITH THE COST ANALYSIS IMPROVEMENT GROUP (CAIG). THE COSTS SHOULD ALSO BE COMPARED TO THOSE PRESENTED TO THE DSARC AT MILESTONE I AND THE COSTS DIFFERENTIALS EXPLAINED.

Figure 1. V/STOL Capable Destroyer

TABLE 1 ANNUAL OPERATING AND SUPPORT COST COMPARISON
(THOUSANDS, FY80$)

DD963 CLASS AND V/STOL DESTROYER*

Cost Element	DD963 Class		V/STOL Destroyer	
Direct Unit Costs		$9,294		$10,946
Manpower	$3,519		$3,630	
TAD	6		6	
Ship POL	4,845		6,450	
Repair Parts	370		372	
Supplies	206		207	
Ammunition	214		107	
Other Expendable Stores	17		17	
Purchased Services	117		157	
Direct Intermediate Maint.		100		100
Afloat Inter. Maint. Activities	57		57	
Shore Inter. Maint. Activities	43		43	
Direct Depot Maintenance		5,374		5,374
Scheduled Ship Overhaul	3,168		3,168	
Non Scheduled Ship Repairs	1,326		1,326	
Fleet Modernization	368		368	
Other Depot	512		512	
Direct Recurring Investment		566		566
Organizational Exchanges	230		230	
Organizational Issues	336		336	
Depot Exchanges	0		0	
Indirect O&S Costs		269		245
Training	180		181	
Publications	23		23	
Engineering & Tech. Svcs	15		15	
Ammo Handling	51		26	
TOTAL		$15,603		$17,231

* Air Detachment costs are not included.

TABLE 2

DSARC I TO DSARC II COMPARISON
ANNUAL OPERATING AND SUPPORT COST
(THOUSANDS, FY80$)

1 V/STOL DESTROYER (LESS AIR DETACHMENT SUPPORT)

Cost Element	Current Est	DSARC I Est	Change	Comments
Direct Unit Costs	$10,946	$9,836		
Manpower	$3,630	$3,297	+$333	1
TAD	6	6	-	
Ship POL	6,450	5,705	+ 745	2
Repair Parts	372	372	-	
Supplies	207	187	+ 20	1
Ammunition	107	107	-	
Other Expendable Stores	17	17	-	
Purchased Services	157	145	+ 12	1
Direct Intermediate Maint.	100	55		
Afloat Inter. Maint. Activities	57	55	+ 2	3
Shore Inter. Maint. Activities	43	40	+ 3	3
Direct Depot Maintenance	5,374	5,374		
Scheduled Ship Overhaul	3,168	3,168		
Non Scheduled Ship Repairs	1,326	1,326		
Fleet Modernization	368	368		
Other Depot	512	512		
Direct Recurring Investment	566	566		
Organizational Exchanges	230	230		
Organizational Issues	336	336		
Depot Exchanges	0	0		
Indirect O&S Costs	245	245		
Training	181	181		
Publications	23	23		
Engineering & Tech Svcs	15	15		
Ammo Handling	26	26		
TOTAL	$17,231	$16,116	+$1,115	

1. Originally it was anticipated that the Air Detachment's and the ship's electronics technicians would be mutually supportive. However, this has proven impractical . . . .

2. Increase is due to a change in POL cost from $1.25/gal to $1.32/gal . . . .

3. Increase is due to a change in the FY79 VAMOSC data vice the FY78 data used for DSARC I . . . .

2. ASSUMPTIONS AND GROUND RULES

2.1 General

The V/STOL capable destroyer will incorporate a DD963 type hull with most of the ship's subsystems . . . .

Although the V/STOL capable destroyer is still under development, the use of the Spruance type hull is a well proven approach . . . . Experience has shown that O&S costs covering basic ship operations do not vary significantly with different missions or are accurately predictable. Therefore . . . .

GUIDANCE: INCLUDE A GENERAL DESCRIPTION OF SYSTEM CHANGES AND DISCUSS THEIR ANTICIPATED IMPACTS ON O&S COSTS INDICATING THE DEGREE OF CONFIDENCE THAT THE CHANGES ARE PRACTICAL AND COST IMPACTS ARE ACCURATE.

2.2 Baseline System

As in the DSARC I report, the DD963 weapon system is used as the reference system. However, the data base was updated to include the latest year's data. The proposed ship's characteristics and mission environment most closely resemble the Spruance class destroyer . . . .

GUIDANCE: IDENTIFY THE BASELINE SYSTEM AND EXPLAIN THE RATIONALE USED IN ITS SELECTION. IF THE BASELINE SYSTEM WAS CHANGED FROM DSARC I EXPLAIN FULLY WHY THE CHANGE WAS NECESSARY.

2.3 System and Program Characteristics

Table 3 illustrates system and program characteristics of the V/STOL capable destroyer and compares them to the baseline system . . . .

GUIDANCE: INCLUDE DETAILS OF THE PROPOSED SYSTEM.

TABLE 3. SHIP CHARACTERISTICS

(Typical)

Element	Baseline Spruance Class DD	Proposed Spruance Class DDV-1
Displ (lt)	5830 tons	8,000 tons
Displ (Full)	7810 tons	11,000 tons
Length	563 feet	564 feet
Beam	55 feet	68 feet
Draught	29 feet	[illegible] feet
Aircraft	2 SH-2D (LAMPS)	[illegible] V/STOL
Guns	2 ea 5 inch (MK 45)	[illegible] ea 5 inch
A/S Weapons	ASROC, [illegible] tube [illegible] 2 triple tube (MK 32)	n/c*
Main Engine	4 GE LM 2500 gas turbine 80,000 SHP 2 shafts	n/c
Speed	33 knots	28 knots
Range	6,000 mi @ 20 knots	4500 mi @ 20 knots
Manning	See Appendix A	See Appendix A
Fire Control	MK 116 (underwater) MK 86 (gunfire) MK 91 (missile FCS) SPQ-60 & SPQ-9 Radars	n/c n/c n/c n/c
Radar	SPS-40 & SPS-55	SPS-48, 55 & TACAN
Rockets	MK 36 Chaffroc	n/c
Sonar	SQS 53	n/c
. . .	. . .	. . .
. . .	. . .	
. . .		

* No change

2.4 Assumptions, Model Inputs, and Rates.

2.4.1 Design Sensitive Values. Table 4 lists the elements that are design-related and dissimiliar to the baseline system.

TABLE 4. DESIGN SENSITIVE VALUES

Elements	Value	Source	Contact	Ext
1. Displacement (lt)	8, 000 tons	PM Projection	Jim Smith	75124
2. Displacement (full)	11, 000 tons	PM Projection	Jim Smith	75124
3. Draught	34 feet	PM Projection	Jim Smith	75124
4. . . .	. . .	. . .	. . .	. . .

2.4.1.1 Displacement (lt). The addition of a flight deck/hanger deck is estimated to add xxxx tons to the basic DD963 displacement weight . . . .

2.4.1.2 Displacement (full). The addition of five V/STOL aircraft, the Air Detachment, and increase in fuel requirements, although somewhat offset by the elimination of two LAMPS craft, will . . . .

2.4.1.3 . . . .

GUIDANCE: DIVIDE VALUES USED IN THE COST ESTIMATING MODEL OR ALGORITHMS INTO TABLES DEPENDING ON THE NATURE OF THE PARAMETER INVOLVED.
DESIGN SENSITIVE VALUES TABLE CONTAINS ELEMENTS WHICH ARE INHERENT TO THE SYSTEM DESIGN AND ARE DEPENDENT ON HARDWARE CONFIGURATION. FOLLOWING THIS TABLE IS A BRIEF EXPLANATION OF THE DERIVATION OF THE VALUE SELECTED FOR THE PARAMETER.

2.4.2 System Operational Standards

Table 5 identifies the values used in this analysis which reflect current Navy policy . . . .

TABLE 5. SYSTEM OPERATIONAL STANDARDS

	Element	Value	Source	Contact	Ext
1.	Ships Complement	290 personnel	See Appendix A		
2.	Acft per ship	5 V/STOL	PM Projection	John Doe	73124
3.	Overhaul Interval	54 mo	OP 43F	Jack Smith	74189
4.	Overhaul Duration	7 mo	OP 43F	Jack Smith	74189
5.	Air Detachment	99 personnel	See Appendix A		
5a.	Aircrew Ratio	2.0	. . .	. . .	

2.4.2.1 Ship's Complement. The basic DD963 class manning document was used, augmented by flight control personnel . . . .

2.4.2.2 Acft per Ship. Although the V/STOL capable destroyer can be designated with sufficient hanger space to accommodate more than 5 aircraft, the capacity for carrying consumable stores . . . .

2.4.2.3 . . .

GUIDANCE: LIST THOSE FACTORS ESTABLISHED BY THE USING COMMAND WHICH IMPACT O&S COSTS IN A TABLE. A BRIEF EXPLANATION AND DERIVATION OF THE VALUE SHOWN FOLLOWS THE TABLE.

2.4.3 Standard Values and Rates

Table 6 lists the standard values and rates used in the source . . . .

TABLE 6. STANDARD VALUES AND RATES

	Element	Value	Source	Contact	Ext
1.	POL Costs (DFM)	$1.32/gal	OPNAV-51C1	Mary Doe	51234
2.	Officer Standard Composite Rate	$27,000	ASD(COMP) Memo	-	-
3.	Enlisted Standard Composite Rate	$11,500	ASD(COMP) Memo	-	-
4.	Escalation Factors	variable	ASD(COMP)	-	-
5.	Base Year Dollars	FY 80	CAIG	Tom Mix	75631

GUIDANCE: HIGHLIGHT THOSE STANDARD VALUES WHICH ARE ESTABLISHED AND GENERALLY ACCEPTED IN A TABLE. THESE VALUES ARE NOT SUBJECT TO INFLUENCE BY THE SYSTEM UNDER CONSIDERATION OR THE USING COMMAND.

3. METHODOLOGY

3.1 General.

For this analysis the Navy O&S cost estimating model was used. A summary of this model is provided in Appendix C . . . .

GUIDANCE: IF A GENERALLY APPLICABLE COMPUTERIZED COST ESTIMATING MODEL IS USED INSTEAD OF THE SERIES OF ALGORITHMS LISTED IN APPENDIX B OF THIS REPORT, INCLUDE SUMMARY OF THE MODEL USED, AS WELL AS APPROPRIATE COMPUTER PRODUCTS, IN APPENDIX C AND OMIT APPENDIX B.

3.2 Data Sources.

The sources used in defining the baseline costs and the method used in estimating the proposed system's cost are listed in Table 7 for each of the cost elements . . . .

GUIDANCE: INCLUDE A MATRIX OF SOURCES AND METHODS IN THE REPORT.

3.3 Data Base.

The cost data for 13 Spruance class destroyers were averaged in determining baseline costs (See page B-2). . . . This minimizes the impact of a specific ship's commitment during the period of cost data collection and at the same time ensures that a cross section of the varied missions of this type ship was included in the cost data . . . .

GUIDANCE: IF THE DATA BASE OF THE BASELINE SYSTEM DOES NOT CONTAIN SUFFICIENT UNITS TO ENSURE THAT ALL TYPES OF SHIP'S OPERATIONS ARE CONSIDERED (I.E., UNDERWAY, ASHORE, UNDERGOING IMA, DEPOT OVERHAUL, WEAPONS FIRING, ETC), THE PROPOSED SHIP'S TOTAL OPERATION MUST BE BROKEN INTO ITS ELEMENTAL MISSIONS AND EACH ELEMENT CONSIDERED IN DEVELOPING O&S COST ESTIMATES.

TABLE 7. DATA SOURCE AND METHODOLOGY

Cost Element	DD963 CLASS Source	DD963 CLASS Method	V/STOL DESTROYER Source	V/STOL DESTROYER Method
		Existing Data:		
DIRECT UNIT COSTS				
Manpower	OPNAVINST 5320.20B AST (COMP) Memo	Normalized to a ship/yr	Manpower Analysis: ASD (COMP) Memo	See Appendix A
ZAD	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by enlisted population
POL	NAVPAS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by displacement
Repair Parts	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Less 5 inch gun, plus [illegible]
Supplies	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by total [illegible] population
Ammunition	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Less one 5 inch gun
Other Expendable Stores	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Purchased Services	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by manning differences
DIRECT INTERMEDIATE MAINTENANCE				
Afloat IMA	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Shore IMA	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
DIRECT DEPOT MAINTENANCE				
Scheduled Ship Overhaul	Fleet Ship Overhaul Funding Outline Report (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Non Scheduled Repair	[illegible]	N/A		Baseline figure used
Fleet Modernization	VAMOSC-Ships TSS RPT (By type ship) (FY79)	DD class data used	Baseline	Baseline figure used
Other Depot	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
DIRECT RECURRING INVESTMENT				
Organizational Exchanges	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Organizational Issues	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by Organizational Exchanges
Depot Issues	No cost reflected, see Organizational Exchanges			
INDIRECT O&S COSTS				
Training	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by enlisted population
Publications	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Engineering & Tech Svcs	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
ADMIN Handling	VAMOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used less support of one 5-inch gun

3.4 Derivation of Estimates.

In applying the baseline data to the V/STOL capable destroyer and projecting costs it was necessary to establish a proportional relationship between the two systems. These proportions are explained in the following paragraphs.

GUIDANCE: ESTABLISH SOME PROPORTIONAL RELATIONSHIP BETWEEN THE BASELINE SYSTEM AND THE ALTERNATIVES WHEN COST ANALYSIS DATA IS NOT DIRECTLY AVAILABLE FROM THE WEAPON SYSTEM UNDER CONSIDERATION. THIS RELATIONSHIP IS THEN USED TO SCALE THE BASELINE COSTS TO DETERMINE THE ESTIMATED COSTS OF THE ALTERNATIVE SYSTEMS. WHEN THE DERIVATION OF A VALUE USED IN THE COST ANALYSIS IS COMPLEX, PROVIDE A DETAILED EXPLANATION.

3.4.1 Displacement (lt). As a measure of depot overhaul costs, the ship displacement is . . . . The derivation of the scalars is as follows.

Scalar = V/STOL capable destroyer disp. ÷ DD963 disp.
Scalar = 8000 ÷ 5830
Scalar = 1.37

3.4.2 Displacement (full). Since the DD963 and the V/STOL capable destroyer have identical hull designs and power plants the operating fuel consumption while underway is directly related to displacement . . . . The derivation of the scalar follows . . . .

Scalar = V/STOL capable destroyer disp ÷ DD 963 disp.
Scalar = 11,000 ÷ 7810
Scalar = 1.41
....

3.4.3 Depot Scheduled Overhaul Costs

Since the first DD963 is not scheduled for depot overhaul until FY 1982, the baseline costs used the DDG2 Adams class . . . .

. . . . The DDG2, Adams class, destroyer was selected as representative rather than the DD931, Forrest Sherman class, because . . . .

FY79 COSTS (FY80$)

DDG - $12.854M	DDG - $23.245M	DDG - $12.777M	DDG - $13.778M	DDG - $14.470M	DDG - $16.395M
DDG - $17.472M	DDG - $17.857M	Ave $16.106M			

Note: The FY79 costs contain a 28% inflation factor for the fleet upgrade overhaul, over and above normal overhaul costs; therefore, the FY79 data reflected has been deflated to compensate . . . .

Interval between overhaul - 54 months
Overhaul duration - 7 months
Overhaul cycle 61 months

annual costs = (overhaul costs ÷ overhaul cycle) x 12 months
annual costs = ($16.106M ÷ 61 mo) x 12 mo = $3,168K/ship/yr

4. SENSITIVITY/RISK ANALYSIS

Although the V/STOL capable destroyer is still undergoing development, there is sufficient detail known to provide accurate predictions . . . . It is still necessary to provide some sensitivity of the O&S costs to significant programatic and design parameters . . . .

GUIDANCE: INCLUDE AN INDICATION OF THE SENSITIVITY OF THE COSTS AND, WHERE POSSIBLE, CONFIDENCE OF THE ESTIMATES.

4.1 General.

Manpower and POL are the major cost drivers . . . .

GUIDANCE: DEVELOP A FURTHER, DETAILED ANALYSIS OF THE COST IMPACT OF EACH COST DRIVER ESPECIALLY THOSE OF WHICH THE VALUE COULD VARY WIDELY. IDENTIFY THE RANGE OF VALUES SELECTED FOR SENSITIVITY ANALYSIS AND THE RATIONALE FOR SELECTION. PRESENT THE RESULTS OF DIFFERENT SENSITIVITIES USING THE SAME GRAPHICAL SCALE WHENEVER POSSIBLE TO FACILITATE A COMPARISON.

4.2 Manning.

The potential for cost avoidance by reducing manning is very slight . . . . Manning of the DD963 class, on which the V/STOL destroyer manning is based, reflects minimums predicated on existing Navy ship manning policy. . . . Personnel support facilities on the V/STOL destroyer will not allow significant increases . . .

4.3 POL.

The potential for cost variations in POL costs is caused by two independent variables: unit cost of fuel and consumption . . . . Figure 2 depicts the potential POL costs for various consumption rates and unit costs . . . .

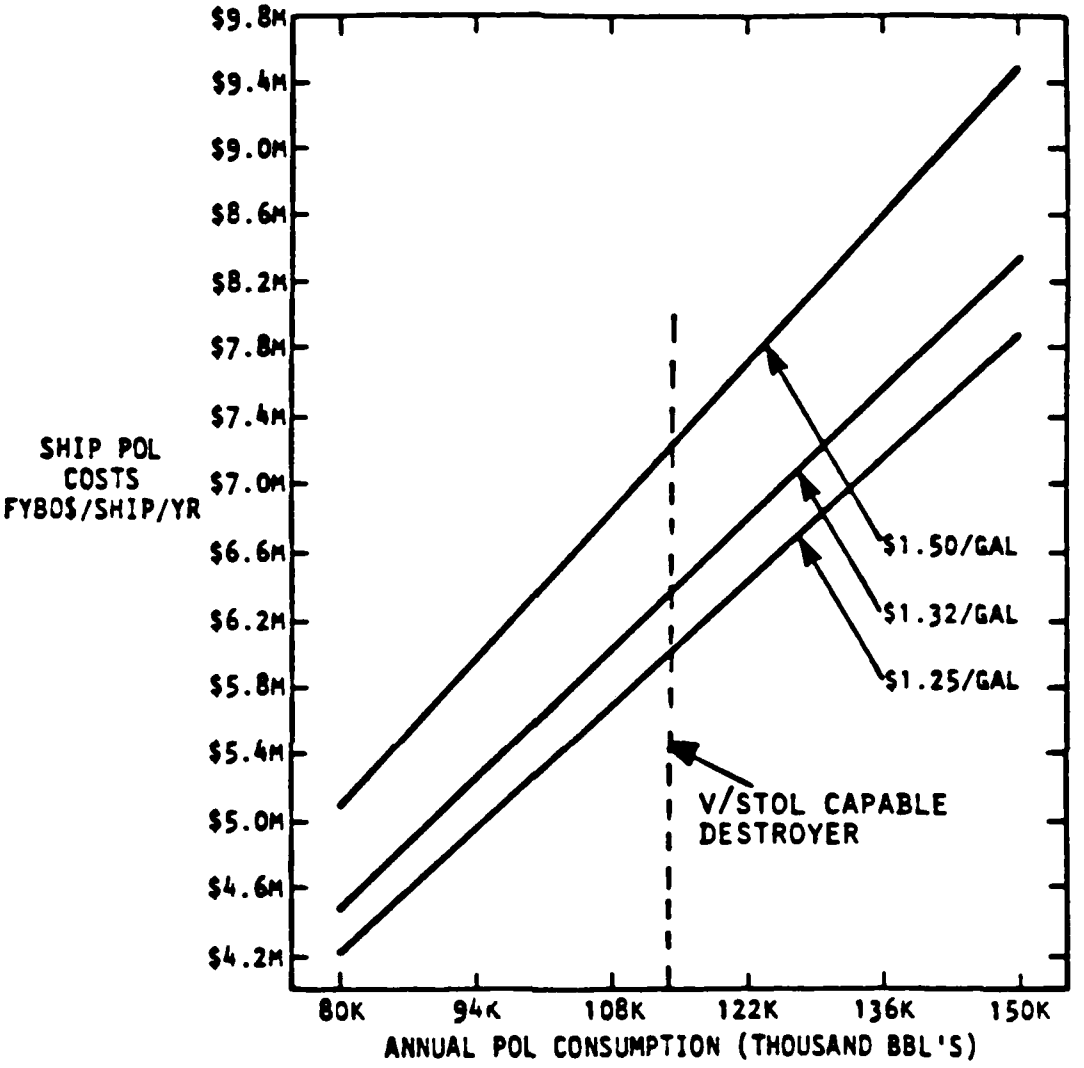

FIGURE 2. POL SENSITIVITY GRAPH

5. SUMMARY

Still to be resolved are the separation of major system repairs from the Other Depot costs . . . .

Although the V/STOL destroyer utilizes the existing hull, propulsion and many subsystems of the Spruance class destroyer, the DD963 class, as a whole, has yet to undergo depot overhaul. Therefore . . . .

GUIDANCE: INDICATE ISSUES LEFT UNRESOLVED OR THOSE WHICH WILL RECEIVE CLOSE SCRUTINY IN THE FUTURE. IDENTIFY ANTICIPATED REFINEMENTS AND NEW APPROACHES TO THE COST ESTIMATING TECHNIQUES.

APPENDIX A. SHIP'S PERSONNEL

A.1 General.

The V/STOL capable destroyer will have the basic Spruance class destroyer hull and offensive/defensive systems . . . . Therefore, the Ship Manpower Document, DD963 Class, was used as the V/STOL destroyer manning document . . . .

A.2 5 inch gun.

Within the CA Division there is a reduction of three Gunner's Mates. This is due to the outfitting of one less 5 inch gun . . . .

A.3 OA Division.

The OA Division (Air Operations) was added to the V/STOL capable destroyer manning to accommodate the ship operations/flying operations interface. The additional officer and four enlisted personnel will provide the manning in the Combat Information Center . . . .

A.4 Air Detachment.

The 99 personnel in the Air Detachment will provide for a 2.0 flight crew ratio and limited aircraft maintenance . . . . (Note: These personnel are not costed in this report.)

GUIDANCE: EXPLAIN THE RATIONALE BEHIND MANNING CHANGES TO THE BASELINE SYSTEM. WHEN THE ALTERNATIVE SYSTEM INCORPORATES NEW CONCEPTS OR A RADICAL DEPARTURE FROM EXISTING SYSTEMS/METHODS, EXPLAIN IN DETAIL THE CHANGE AND ITS EXPECTED IMPACT ON MANNING.

A.5 Facilities.

The 101 additional billets will be accommodated by the increase in the ship's size. However, the added space and capacity will not provide for conventional organizational and intermediate level aircraft maintenance or extensive increases in operating spares . . . .

GUIDANCE: INCLUDE A DETAILED NARRATION OF FACTORS THAT IMPINGE ON MAINTENANCE MANNING AS A WHOLE, SUCH AS CAPACITY OF FACILITIES, THROWAWAY VS. REPAIR IMPACT, AND MAINTENANCE CONCEPT.

A.6 Personnel Facilities

In order to compensate for the net gain in embarked personnel (Air Detachment on board) berthing space has been increased and habitability standards have been reduced slightly. These reductions include . . . .

TABLE A.1 SHIP'S COMPLEMENT

Manning Element	DD963		V/STOL Destroyer	
	Officer	Enlisted	Officer	Enlisted
Executive Department	2	7	2	7
CO Afloat	1	0	1	0
XO Afloat	1	0	1	0
Executive Division	0	7	0	7
Navigation Department	1	7	1	7
Ship NAVIGAGEN	1	0	1	0
N Division	0	5	0	5
H Division	0	2	0	2
Operations Department	4	84	5	88
Ops Aflt NTDS	1	0	1	0
OC Division	1	19	1	19
OI Division	1	23	1	23
OD Division	1	40	1	40
V Division	0	-	0	-
OA Division	0	0	1	4
Combat Systems Department		75	5	72
Weapons Gen	1	0	1	0
CD Division	0	7	0	7
CE Division	1	11	1	11
CI Division	0	6	0	6
CO Division	1	11	1	11
CF Division	1	12	1	12
CA Division	1	28	1	25
Engineering Department	4	65	4	65
Ship Eng GASTBN	1	0	1	0
A Division	0	10	0	10
E Division	1	11	1	11
R Division	1	13	1	13
MP Division	1	31	1	31
Supply Department	2	32	2	32
General Supply	1	0	1	0
S-1 Division	0	5	0	5
S-2 Division	0	19	0	19
S-3 Division	0	6	0	6
S-4 Division	1	2	1	2
Total Ships Complement	18	270	19	271
Air Detachment*	-	-		
Aircrew	-	-	10	
Maintenance	-	-	0	71
Other	-	-	0	18

*Not included in O&S costs

APPENDIX B. MATHEMATICAL COMPUTATIONS

(All results in thousands)

GUIDANCE: MATHEMATICAL COMPUTATIONS AND FORMULAS/ALGORITHMS LISTED IN APPENDIX B SHOULD NOT BE DUPLICATED IN APPENDIX C. NORMALLY, WHEN APPENDIX B IS USED APPENDIX C IS OMITTED.

The following computations support the cost figures contained in the main body of this report . . . .

FY79 VAMOSC DATA, DD963 CLASS
(Thousand $)

ELEMENT	HULL NUMBER													
	96-	96-	96-	96-	96-	96-	97-	97-	97-	97-	97-	97-	97-	Ave
TAD	10	2	4	7	2	6	3	2	6	19	5	2	5	6
Repair Parts	460	320	290	250	340	480	440	480	440	310	270	300	180	349
Supplies	180	160	140	110	180	240	310	270	170	180	210	200	200	194
Ammo	260	270	190	250	400	180	160	160	220	80	160	40	250	202
Other Expend Stores	20	1	20	30	50	50	30	10	6	0	0	0	0	16
Purchased Svcs	50	250	140	160	140	90	50	30	200	90	90	100	50	110
Printing	0	0	1	1	2	0	0	0	1	0	1	0	1	1
ADP & Rental Cont Svcs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rent & Utilities	4	230	110	130	120	50	20	0	190	70	40	40	2	76
Comm	1	0	0	0	0	2	1	1	0	0	0	0	1	0
Other	45	20	30	30	20	40	30	30	10	20	50	60	50	33
Afloat IMA	70	150	60	40	60	60	60	60	30	20	30	30	40	53
Shore IMA	50	110	30	30	30	60	40	50	30	20	20	20	30	41
Fleet Modernization	0	0	0	0	0	0	4	5	0	10	957	1105	930	232
Other Depot (less ord)	546	574	487	426	456	453	453	498	486	456	499	452	423	460
Ord Rework	0	7	0	2	0	10	3	3	4	1	5	7	1	3
H,M&E Rework	Not avail, See other Depot													
Electronic Rework	Not avail, See other Depot													
Other	Not avail, See other Depot													
Organizational Exchange	180	200	340	180	210	280	180	150	340	240	210	210	120	217
Organizational Issues	60	90	150	70	180	90	590	11420	1760	80	60	640	30	317
Depot Exchanges	0	0	0	0	0	0	0	0	10	0	0	0	0	0
Training	130	150	110	110	130	120	190	160	160	170	290	250	240	170
Publications	20	20	10	30	20	50	30	8	20	20	20	30	10	22
Eng & Tech Svcs	30	10	10	10	6	8	30	50	30	10	2	6	4	14
Ammo Handling	70	80	0	30	60	70	30	30	40	40	60	60	60	48

* Figure omitted in average.

DD 963 CLASS

V/STOL DESTROYER

DIRECT UNIT COSTS

Manpower	
Officer x rate = officer costs 18 x $27,000 = $486K Enlisted x rate = enlisted costs 270 x $11,500 = $3,105K Total costs = officer + enlisted costs $486K + $3,105K = $3,591K/ship/yr	Officer x rate = officer costs 19 x $27,000 = $513K Enlisted x rate = enlisted costs 271 x $11,500 = $3,116.5 Total costs = officer + enlisted costs $513K + $3,117K = $3,630K/ship/yr
TAD	
FY79 costs x escalation = FY80 costs $6K x 1.0604 = $6K/ship/yr	Baseline V/STOL destroyer enlisted population ÷ DD963 enlisted population $6K x (271 ÷ 278) = $6K/ship/yr

Ship POL

DD 963 CLASS

SOURCE: NAVY ENERGY USAGE PROFILE AND ANALYSIS SYSTEMS (NEUPAS, FY 79)

Ship Consumption (bbls) FY79

HULL	UNDERWAY	NOT UNDERWAY	AUXILIARY	TOTAL
96-	87,800	22,800	33	110,633
96-	46,700	14,200	36	60,936
96-	89,800	12,600	5	102,405
96-	102,100	12,700	9	114,809
96-	125,000	9,900	1	134,644
96-	112,300	17,300	27	129,636
97-	85,500	23,800	42	109,342
97-	72,400	27,100	18	99,487
97-	54,300	5,600	5	59,875
97-	38,600	11,400	30	50,036
97-	48,400	15,000	7	63,407
97-	27,000	22,300	1383	50,707
97-	31,000	18,600	5	50,105
Total	[illegible]	[illegible],330	1643	1,136,201
Average (AVE)	70,864	16,410	126	87,400

Ave annual consumption x unit cost = ship POL cost
87,400 bbls x 42 gal/bbl x $1.32/gal = $4,845K/ship/yr

V/STOL DESTROYER

Baseline underway x (V/STOL destroyer displacement (full) ÷ DD963 displacement (full)) = bbls underway

bbls underway + baseline bbls not underway + baseline bbls auxiliary = total bbls

total bbls x 42 gal/bbls x $1.32/gal = POL costs

70,864 x (11,000 tons ÷ 7810 tons) = 99,808 bbls

99,808 bbls + 16,410 bbls + 126 bbls = 116,344 bbls

116,344 bbls x 42 x $1.32 = $6,450K/ship/yr

DD 963 CLASS	V/STOL DESTROYER
Repair Parts FY 79 costs x escalation = FY80 costs $349K x 1.0604 = $370K/ship/yr	Baseline - (cost of one 5 inch gun plus increase cost of E, M & E parts) $370K - ($1K + $3K) = $372K/ship/year
Supplies FY79 costs x escalation = FY80 costs $194K x 1.0604 = $206K/ship/yr	Baseline x (V/STOL destroyer manning + DD 963 class manning) $206K x (290 + 288) = $207K/ship/year
Ammunition (5 inch gun) FY79 cost x escalation = FY80 costs $202K x 1.0604 = $214K/ship/yr	Baseline x (no. of guns on V/STOL Destroyer + no. of guns on DD963 class destroyer) $214K x (1+2) = $642K/ship/year
Other Expendable Stores FY79 costs x escalation = FY80 costs $16K x 1.0604 = $17K/ship/yr	Baseline equipage = V/STOL destroyer equipage $17K/ship/yr
Purchased Services Service — FY79 — FY80 Printing — $1K — $1K ADP & contract svc — 0 — 0 Rent & utilities — $77K — $81K Communications — 0 — 0 Other — $33K — $35K	No change = $1K No change = 0 Baseline x (V/STOL destroyer manning + Air detachment manning) ÷ DD963 manning $81K x (290 + 99) ÷ 288 = $109K No change = 0 Baseline x (V/STOL destroyer manning + Air detachment manning) ÷ DD963 manning $35K x (290 + 99) ÷ 288 = $47K
Total $117K/ship/yr	$157K/ship/yr

DIRECT INTERMEDIATE MAINTENANCE

Afloat IMA FY79 costs x escalation = FY80 costs $53K x 1.0604 = $57K/ship/yr	Baseline = V/STOL destroyer $57K/ship/yr
Shore IMA FY79 costs x escalation = FY80 costs $41K x 1.0604 = $43K/ship/yr	Baseline = V/STOL destroyer $43K/ship/yr

DIRECT DEPOT MAINTENANCE

DD 963 CLASS	V/STOL DESTROYER
Scheduled Ship Overhaul FY80 costs (see para 3.5)= $3168K/ship/yr	Baseline figure used
Non Scheduled Repair FY79 costs (see table 7) x escalation $1,250K x 1.0604 = $1326K/ship/yr	Baseline figure used
Fleet Modernization FY79 cost x escalation = FY80 costs $347K (DD class) x 1.0604 = $368K/ship/yr	Baseline figure used
Other Depot (Other depot + ord rework) x escalation = FY80 costs ($480K + $3K) x 1.0604 = $512K/ship/yr Note: H, M & E and electronic rework breakout unavailable	DD 963 cost = V/STOL destroyer cost $512K/ship/yr

DIRECT RECURRING INVESTMENT

Organizational Exchanges FY79 costs x escalation = FY80 costs $217K x 1.0604 = $230K/ship/yr	DD 963 costs = V/STOL destroyer costs $230K/ship/yr
Organizational Issues FY 79 costs x escalation = FY80 costs $317K x 1.0604 = $336K/ship/yr	DD963 costs x (V/STOL destroyer organizational exchanges ÷ DD963 organizational exchanges) $336K x (230 ÷ 230) = $336K/ship/yr
Depot Exchanges Figures reflected under organizational exchanges	

INDIRECT O & S COSTS

Training RY79 costs x escalation = FY80 cost $170K x 1.0604 = $180K/ship/yr	Baseline cost x (V/STOL destroyer enlisted population ÷ DD963 enlisted population) $180K x (271 ÷ 170) = $181K/ship/yr

DD963	V/STOL DESTROYER
Publications	
FY79 cost x escalation = FY80 cost $22K x 1.0604 = $23K/ship/yr	DD963 cost = V/STOL destroyer cost $23K/ship/yr
Engineering and Technical Services	
FY79 cost x escalation = FY80 cost $14K x 1.0604 = $15K/ship/yr	DD963 cost = V/STOL destroyer cost $15K/ship/yr
Ammo Handling	
FY79 cost x escalation = FY80 cost $48K x 1.0604 = $51K/ship/yr	Baseline x (no of guns on V/STOL destroyer ÷ no of guns on DD963 class destroyer) $51K x (1 ÷ 2) = $26K/ship/yr

APPENDIX C. O&S COST ESTIMATING MODEL

C.1 General.

For this analysis the Navy . . . model was used . . . . This model is a deterministic mathematical model which is preprogrammed and modularly structured . . . .

C.2 Use & Application

This model has been in use since . . . calculates annual ships operating costs . . . .

C.3 Model Logic.

Table C-1 lists the algorithms used in the model logic . . . .

C.4 Results.

Tables C.2.A through C.2. ( ) are the computer products identifying both input values and results for each alternative . . . .

GUIDANCE: WHEN APPENDIX C IS USED APPENDIX B WILL BE OMITTED, THE FORMAT USED AND THE INFORMATION PROVIDED IN APPENDIX C DEPEND ON THE COMPUTER MODEL USED.

TABLE C.1. O&S COST ESTIMATING MODEL ALGORITHMS

Direct Unit Costs
  Manpower
  A = Officer x officer rate + enlisted x enlisted rate + civilian x civilian rate

  Temporary Additional Duty
  B = Baseline x proposed enlisted manning ÷ Baseline enlisted manning

  POL
  B = Underway consumption mix x steaming hours mix x scalar + not underway and auxillary

  C = Results of B x unit costs

  Repair Parts
  D = ooo

o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o

Engineering and Technical Services
  TT = ...

Ammo Handling
  UU = ...

TABLE C.2.A. ANNUAL SHIP OPERATION AND SUPPORT COST ANALYSIS

Model:
TIME: 1719.0 Fri 02/08/80

COMPUTER PROGRAM:
DATA FILE:

GENERAL

DD963 class

STEAMING HOURS -

INPUT VALUES	OFFICER	ENLISTED	CIVILIAN	TOTAL
Ship's Complement	18	270	0	288
Baseline Costs			0	
. . .			0	

POL Costs - $1.32/gal

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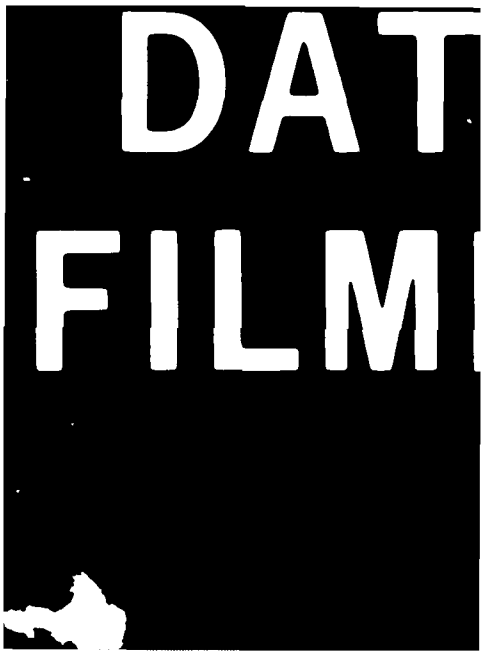
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